MULTIMEDIA UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2019/2020

BEC2044 –ECONOMETRICS I

(All sections / Groups)

19 OCTOBER 2019
2.30 p.m. - 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of **SEVEN (7)** pages with **FOUR (4)** questions only excluding cover page.
2. Attempt **ALL** questions. The distribution of the marks for each question is given.
3. Write all your answers in the answer booklet provided.
4. Formulas and statistical tables are attached in pages 5–7.

Students are not allowed to take this question paper out of the examination hall.

QUESTION 1 (25 marks)

The starting salary (salary) for fresh graduates of an economics school is determined by

$$\log(\text{salary}) = \beta_1 + \beta_2 \text{GPA} + \beta_3 \log(\text{libvol}) + \beta_4 \log(\text{cost}) + \beta_5 \text{rank} + u \quad \ldots (1.1)$$

where
GPA = the college Grade Point Average (GPA) for the class,
libvol = the number of volumes in the economics school library,
cost = the annual cost of attending economics school,
rank = the ranking of an economics school (with rank=1 being the best), and
log = natural logarithm.

(a) Explain why we expect $\beta_5 \leq 0$. (2 marks)

(b) What signs do you expect for the parameters of β_2, β_3, and β_4? Justify your answers. (6 marks)

(c) The estimated equation based on the **Model (1.1)** produced the following result (standard errors are in parentheses):

$$\widehat{\log(\text{salary})} = \underset{(0.32)}{8.31} + \underset{(0.041)}{0.248\,\text{GPA}} + \underset{(0.0054)}{0.095\log(\text{libvol})} + \underset{(0.041)}{0.038\log(\text{cost})} - \underset{(0.0054)}{0.0033\,\text{rank}}$$

$n = 136$ $R^2 = 0.842$ Jarque-Bera statistic = 4.05

(i) What is the predicted difference in salary for schools with a median GPA different by one point, ceteris paribus? (Report your answer in percentage.) (3 marks)

(ii) Compute the value of adjusted R^2. (2 marks)

(iii) Is the error term normally distributed? Use 5% significance level. (4 marks)

(iv) Does GPA affect the salary significantly? Use 5% significance level. (4 marks)

(v) Test if the variations in all the explanatory variables explain the variation in the dependent variable. Use 5% significance level. (4 marks)

Continued...

QUESTION 2 (25 marks)

(a) State **THREE** consequences each of the Ordinary Least Square (OLS) estimators if the model has:

(i) heteroscedasticity (5 marks)

(ii) autocorrelation (5 marks)

(b) Using monthly data from 2010M1 to 2017M12, a study on industrial employment in Malaysia obtained the following estimation result:

$$\hat{LEMP}_t = -3.89 + 0.51LINCM_t - 0.25LWAGE_t + 0.621LG_t. \qquad DW\ d = 1.147$$

where (all variables are in logarithmic terms (L)),
EMP = total employment,
INCM = total income,
WAGE = the average hourly wage rate, and
G = the total expenditure of the local governments in the area.

State the hypothesis and determine if there is first-order autocorrelation using the Durbin-Watson d test. (6 marks)

(c) Consider the model below:

$$Sales_i = \alpha + \beta Y_i + \gamma M_i + \mu_i$$

where
$Sales_i$ = the sale of a firm in the i-th region,
Y_i = total income in the region, and
M_i = the amount of money spent on advertising by a firm in that region.

You suspect that the random error term μ_i has heteroscedasticity with a standard deviation σ that depends on the amount of money spent on advertising, M_i. Describe the procedure of White test in testing the heteroscedasticity. (9 marks)

Continued...

QUESTION 3 (25 marks)

(a) Suppose you estimate the following two econometric models:

$$\ln Y = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \varepsilon \quad \ldots (3.1)$$

$$\ln Y = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + u \quad \ldots (3.2)$$

where ε and u are independent and identically distributed (iid) disturbances and X_4 is an irrelevant variable which does not enter into the data generating process for ln Y.

(i) Will the value of R^2 be higher in **Model (3.2)** than **Model (3.1)**? Explain your answers. (3 marks)

(ii) Will the value of Adjusted R^2 be higher in **Model (3.2)** than **Model (3.1)**? Explain your answers. (3 marks)

(iii) What are the consequences of including an irrelevant variable in estimation? (3 marks)

(iv) How can we detect the presence of irrelevant variables in our model? (4 marks)

(v) It is better to include irrelevant variables than to exclude the relevant ones. Do you agree? Explain. (2 marks)

(b) The researcher estimates a model with the dependent variable of the daily returns on a given share traded on the London Stock Exchange, and various macroeconomic variables and accounting ratios as independent variables. She attempts to estimate this model, together with five daily dummy variables (Monday to Friday, one for each day), and a constant term, using EViews. However, the result of the Eviews shows that the parameters of the model cannot be estimated.

(i) Explain what has probably happened. (4 marks)

(ii) Provide **TWO (2)** solutions to how the researcher can fix the problem. (6 marks)

Continued...

QUESTION 4 (25 marks)

(a) Describe the **FIVE** attributes of a good model. (10 marks)

(b) (i) Explain what is meant by high, but not perfect multicollinearity. (4 marks)

(ii) Discuss **TWO** methods for how the multicollinearity can be detected. (5 marks)

(iii) Suggest **TWO** solutions to overcome the problems resulting from serious multicollinearity. (6 marks)

End of Questions

Formulas

$$\text{t - statistic} = \frac{\hat{\beta} - \beta}{se(\hat{\beta})}$$

$$R^2 = \frac{\text{Explained Sum of Squares}}{\text{Total Sum of Squares}}$$

$$\text{Adjusted } R^2 = 1 - (1 - R^2)\left(\frac{n-1}{n-k-1}\right)$$

Total Sum of Squares (TSS) = Explained Sum of Squares (ESS) + Residual Sum of Squares (RSS)

$$\text{F - statistic} = \frac{ESS/(k)}{RSS/(n-k-1)} = \frac{R^2/(k)}{(1-R^2)/(n-k-1)}$$

White's general heteroscedasticity test statistics, $\chi^2_{df=k} = n \times R^2$

rho, $\rho \approx 1 - (d/2)$

Tolerance = $(1 - R^2_{\text{auxiliary regression}})$

Statistical Tables

Appendix 1: t-Table

two tails	**0.2**	**0.1**	**0.05**	**0.02**	**0.01**
One tail	**0.1**	**0.05**	**0.025**	**0.01**	**0.005**
df					
10	1.37	1.81	2.23	2.76	3.17
20	1.33	1.72	2.09	2.53	2.84
30	1.31	1.70	2.04	2.46	2.75
40	1.30	1.68	2.02	2.42	2.70
50	1.30	1.68	2.01	2.40	2.68
60	1.30	1.67	2.00	2.39	2.66
75	1.29	1.67	1.99	2.38	2.64
100	1.29	1.66	1.98	2.36	2.63
120	1.29	1.66	1.98	2.36	2.62

Appendix 2: F-table (α=0.05)

df2\df1	1	2	3	4	5	6	7	8
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18
50	4.03	3.18	2.79	2.56	2.40	2.29	2.20	2.13
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10
70	3.98	3.13	2.74	2.50	2.35	2.23	2.14	2.07
80	3.96	3.11	2.72	2.49	2.33	2.21	2.13	2.06
100	3.94	3.09	2.7	2.46	2.31	2.19	2.10	2.03
200	3.89	3.04	2.65	2.42	2.26	2.14	2.06	1.98
500	3.86	3.01	2.62	2.39	2.23	2.12	2.03	1.96
1000	3.85	3.00	2.61	2.38	2.22	2.11	2.02	1.95

Appendix 3: Chi-square table (α=0.05)

df	α = 0.05
1	3.84
2	5.99
3	7.82
4	9.49
5	11.07
10	18.31
20	31.41
30	43.77
40	55.76
50	67.51
100	124.34

Appendix 4: Durbin Watson d Table

Critical Values for the Durbin-Watson Statistic (d)

Level of Significance $\alpha = 0.05$

n	$k=1$		$k=2$		$k=3$		$k=4$		$k=5$	
	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U
10	0.88	1.32	0.70	1.64	0.53	2.02	0.38	2.41	0.24	2.82
15	1.08	1.36	0.95	1.54	0.82	1.75	0.69	1.97	0.56	2.21
20	1.20	1.41	1.10	1.54	1.00	1.68	0.90	1.83	0.79	1.99
25	1.29	1.41	1.21	1.55	1.12	1.66	1.04	1.77	0.95	1.89
30	1.35	1.49	1.28	1.57	1.21	1.65	1.14	1.74	1.07	1.83
40	1.44	1.54	1.39	1.60	1.34	1.66	1.29	1.72	1.23	1.79
50	1.50	1.59	1.46	1.63	1.42	1.67	1.38	1.72	1.34	1.77
60	1.55	1.62	1.51	1.65	1.48	1.69	1.44	1.73	1.41	1.77
70	1.58	1.64	1.55	1.67	1.52	1.70	1.49	1.74	1.46	1.77
80	1.61	1.66	1.59	1.69	1.56	1.72	1.53	1.74	1.51	1.77
90	1.63	1.68	1.61	1.70	1.59	1.73	1.57	1.75	1.54	1.78
100	1.65	1.69	1.63	1.72	1.61	1.74	1.59	1.76	1.57	1.78
150	1.72	1.75	1.71	1.76	1.69	1.77	1.68	1.79	1.66	1.80
200	1.76	1.78	1.75	1.79	1.74	1.80	1.73	1.81	1.72	1.82

n	$k=6$		$k=7$		$k=8$		$k=9$		$k=10$	
	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U	d_L	d_U
10	–	–	–	–	–	–	–	–	–	–
15	0.45	2.47	0.34	2.73	0.25	2.98	0.18	3.22	0.11	3.44
20	0.69	2.16	0.60	2.34	0.50	2.52	0.42	2.70	0.34	2.89
25	0.87	2.01	0.78	2.14	0.70	2.28	0.62	2.42	0.54	2.56
30	1.00	1.93	0.93	2.03	0.85	2.14	0.78	2.25	0.71	2.36
40	1.18	1.85	1.12	1.92	1.06	2.00	1.01	2.07	0.95	2.15
50	1.29	1.82	1.25	1.88	1.20	1.93	1.16	1.99	1.11	2.04
60	1.37	1.81	1.34	1.85	1.30	1.89	1.26	1.94	1.22	1.98
70	1.43	1.80	1.40	1.84	1.37	1.87	1.34	1.91	1.31	1.95
80	1.48	1.80	1.45	1.83	1.43	1.86	1.40	1.89	1.37	1.93
90	1.52	1.80	1.49	1.83	1.47	1.85	1.45	1.88	1.42	1.91
100	1.55	1.80	1.53	1.83	1.50	1.85	1.48	1.87	1.46	1.90
150	1.65	1.82	1.64	1.83	1.62	1.85	1.60	1.86	1.59	1.88
200	1.71	1.83	1.70	1.84	1.69	1.85	1.68	1.86	1.67	1.87

where n = number of observations and k = number of independent variables, excluding the intercept.

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